Algebra 2

Some Algebra 2 standards are intended to cover many parts of the content outline, if not the entire course, and, as such, are listed in several places in the outline.

Course Description

Algebra 2 course competencies are presented for a one-year traditional or one-semester block course that meets the state Algebra 2 standards.

Algebra 2 contains an in-depth study of functions, patterns, relations, and concepts of number systems. This includes linear, quadratic, exponential, absolute value, radical, and rational functions. Conic sections are also addressed.

The course consists of

- the identification of appropriate domains and ranges of functions;
- the collection and organization of data, recording results, and graphical representations;
- the use of symbolic reasoning to represent algebraic situations;
- the expansion of functions for mathematical modeling to develop a versatile and powerful means for analyzing and describing their world; and
- the understanding of properties that govern the use of symbols in expressions, equations, and inequalities.

In Algebra 2, handheld calculators are required as part of instruction and assessment. Students should use a variety of representations (e.g., concrete, numerical, algorithmic, graphical), tools (e.g., matrices, data), and technologies to model situations to solve meaningful problems. Technologies include, but are not limited to, powerful and accessible handheld calculators, as well as computers with graphing capabilities.

Recommended Prerequisites

Students entering this course should have successfully completed Algebra 1, mastering the state-mandated Algebra 1 standards.

Course Outline

This outline of Algebra 2 includes all of the Algebra 2 standards, as well as additional topics. Boldfaced items are not eligible for end-of-course testing. However, they are recommended as additional topics for the honors-level course. All topics should be taught in greater depth and difficulty at the honors level.

I. Linear functions.
   A. Collect data and record results. **Algebra 1: I.B.4.,5.**
      1. Organize data.
      2. Use scatter plots.

3. Determine the line of best fit.

B. With and without graphing calculators, investigate, describe, and predict transformations. **Algebra 1: II.B.3.,6.**

C. Recognize real-world phenomena modeled by linear functions. **Algebra 1: I.B.5; II.C.1.**
   1. Make predictions.
   2. Make decisions and critical judgments using the model.

D. Determine the change in slope relative to the change in the independent variable. **Algebra 1:II.B.6; Algebra 2: I.A.5.**

E. Determine inverse relationships between various functions. **Algebra 2: II.A.4.**

F. Investigate the composition of functions. **Algebra 2: II.A.3**.

II. Solving equations and inequalities.

A. Solve systems of equations or inequalities **Algebra 2: I.B.2**.
   1. Algebraically.
   2. Graphically.
   3. Using matrices.
   4. Using tables (graphing calculators)

B. Verify solutions with and without technology. **Algebra 2: I.B.2.**

C. Demonstrate no solution or multiple solutions. **Algebra 2: I.B.4.**

D. Identify and use properties related to operations with matrices. **Algebra 2: I.B.6**.

E. Analyze situations and formulate systems of equations and inequalities in two or more unknowns in order to solve problems. **Algebra 2: I.B.1.**

F. Analyze absolute value equations and inequalities. **Algebra 2: III.C.3.**

G. Solve linear programming problems with and without technology. **Algebra 2: I.B.5.**

III. Algebraic expressions. **Extension of Algebra 1 concepts**.

A. Radicals. (Algebra I: I.D.1., 6.)
   1. Simplifying.
   2. Operations.

B. Laws of exponents. (Algebra 1: III.B.1.)

IV. Number systems. **Algebra 2: I.B.3.**

A. Real number system and its subsets.

B. Imaginary and complex numbers.

C. Properties.

V. Quadratic functions.

A. Representation of quadratic functions. **Algebra 2: III.A.1.**
   1. Algebraic.
   2. Graphical.
   3. Tabular.
   4. Verbal.

B. Determine reasonable domain and range values for given problem situations. **Algebra 2: I.A.1.,2.**

C. Establish basic concepts of parent functions. **Algebra 2: II.A.1.**

D. Investigate, describe, and predict effects of **Algebra 2: II.A.2.**

1. Vertical and horizontal translations.
2. Reflections and dilations.

E. Recognize real-world phenomena modeled by quadratics. **Algebra 2: I.A.3.4,; III.A.3.; B.3.**
1. Identify maximum and minimum. **III.B.3.**
2. Use parent function to sketch graphs. **III.A.3.**
3. Make predictions. **I.A.4**.
4. Make decisions and critical judgments using the model. **I.A.4.**

F. Use the parent function to investigate, describe, and predict the effects of changes in *a*, *h*, and *k* on the graphs of $y = a(x - h)^2 + k$. **Algebra 2: III.A.3.**

G. Use complex numbers to describe solutions. **Algebra 2: III.A.4**.

VI. Quadratic equations and inequalities.

A. Solve quadratic equations using **Algebra 2: III.B.2.,3.**
1. Factoring.
2. Completing the square.
3. Quadratic formula.

B. Analyze solutions using the discriminant. **Algebra 2: III.B.3.**

C. Formulate quadratic equations to solve problems. **Algebra 2: III.B.1.**

D. Use technology to compare and translate between algebraic and graphical solutions of quadratic equations. **Algebra 2: III.A.2.,III.B.4**.

VII. Rational functions.

A. Determine reasonable domain and range values for given situations. **Algebra 2: I.A.1.,2.**

B. Evaluate. **Algebra 1**

C. Represent rational functions with and without use of technology. **Algebra 2: I.A.3., II.A.1.; IV.A.1.**
1. Algebraic.
2. Tabular.
3. Graphical.
4. Verbal.

D. Solve problems using direct and indirect variation. **Algebra 2: IV. A.2**.

E. Recognize real-world phenomena. **Algebra 2: I.A.4**.
1. Make predictions.
2. Make decisions and critical judgments using the model given.

VIII. Exponential functions.

A. Identify reasonable domain and range. **Algebra 2: I.A.1.,2.**

B. Represent exponential functions. **Algebra 2: I.A.3., II.A.1.; IV.B.1.**
1. Algebraic.
2. Tabular.
3. Graphical.
4. Verbal.

C. Represent exponential functions with and without the use of technology. **Algebra 2: IV.B.1.**

D. Analyze a situation modeled by an exponential function. **Algebra 2: IV.B.2**.

E. Formulate an equation or inequality. **Algebra 2: IV.B.2**.

F. Solve real-world problems. **Algebra 2: I.A.4.;IV. B.2.**
   1. Make predictions.
   2. Make decisions and critical judgments.

IX. Logarithmic functions.

A. Describe the general shape of the graph and the effect of transformations on the domain and range.

B. Develop the connection between exponential and logarithmic functions.

C. Investigate asymptotic behavior.

D. Investigate logarithmic properties graphically and algebraically.

E. Solve exponential and logarithmic equations and inequalities using graphs, tables, algebraic methods, and technology and including reasonableness of solutions.

X. Conic sections.

A. Identify algebraic representations of conics.

B. Determine the type, shape, and location of a conic section through completing the square **Algebra 2: II.B.3**.

C. Graph conic sections.

D. Explain each conic section as the intersection of a plane and cone(s). **Algebra 2: II.B.1.**

E. Identify symmetries from graphs of conic sections. **Algebra 2: II.B.2**.

F. Solve real-world problems.
   1. Make predictions.
   2. Make decisions and critical judgments.

XI. Radical functions and absolute value functions.

A. Represent radical and absolute value functions. **Algebra 2: I.A.3., II.A.1.; III.C.1.**
   1. Algebraic.
   2. Tabular.
   3. Graphical.
   4. Verbal.

B. Solve square root and absolute value equations and inequalities. **Algebra 2: III.C.2.**

C. Verify solutions using technology. **Algebra 2: III.C.2.**

D. Analyze situations modeled by square root and absolute value functions. **Algebra 2: I.A.4.;III.C.3.**

E. Solve problems by formulating equations and inequalities. **Algebra 2: III.C.3.**

F. Determine reasonable domain and range values for given problem situations. **Algebra 2: I.A.1.,2.**

XII. Polynomial functions.

A. Characteristics.

1. Describe the general shape of the graph and the effect of transformations on the domain and range.

2. Recognize the connections among the significant points of a function, the graph of a function, and the algebraic representation of a function.

a. Roots.

b. **Maximum points and minimum points.**

3. **Investigate continuity and end behavior.**

B. Solve polynomial equations and inequalities using graphs, tables, algebraic methods, and technology.

C. Problem situations.

1. **Analyze a verbal, graphical, or tabular representation of a polynomial function.**
2. **Analyze a problem situation by formulating an equation or inequality.**